



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

242. Proposed by J. H. MEYER, S. J., Augusta, Ga.

A given sphere is to be formed into a solid composed of two equal cones on opposite sides of a common base, in such a manner that its surface may be the least possible. Find the dimensions of the solid, and compare its surface with that of the sphere.

Solution by A. H. HOLMES, Brunswick, Maine.

Of the cones into which the given sphere, radius R , is to be transformed, let x =radius of base, and y =altitude.

$$\text{Then } \frac{2\pi x^2 y}{3} = \frac{4\pi R^3}{3} \text{ or } x^2 y = 2R^3 \text{ a minimum, or}$$

$$x^4 + \frac{4R^6}{x^2} = a \text{ minimum.}$$

$$\therefore 4x^3 = \frac{8R^6}{x^3}, \text{ and therefore } x = 2^{\frac{1}{3}} R \text{ and } y = 2^{\frac{2}{3}} R.$$

Put S_1 =surface of sphere, and S_2 =surface of required solid.

Then $S_1 : S_2 = 4 : 2^{\frac{2}{3}} \sqrt{3}$.

Also solved by G. B. M. Zerr.

MECHANICS.

188. Proposed by H. L. ORCHARD, M. A., B. S.

Spherical bubbles of air are rising in water. Find the relation between radius and velocity.

Solution by G. B. M. ZERR, A. M., Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

Let R =radius of bubble at surface of water, r =radius of bubble at start at bottom, δ =density of gas in bubble referred to water as unity, w =weight of one cubic inch of water in pounds, h =height of column of water equal to weight of one atmosphere, d =depth of water where bubble starts, v =velocity of bubble at distance s from starting point, bubble starting from rest, x =radius of bubble at distance s from starting point, f =acceleration.

$\therefore \frac{4}{3}\pi R^3 w \delta$ =weight of gas in pounds, $\frac{4}{3}\pi R^3 w$ =force, in pounds, impelling bubble upwards.

$$\therefore f = \frac{\frac{4}{3}\pi R^3 w (1-\delta)g}{\frac{4}{3}\pi R^3 w (1+\delta)} = \frac{(1-\delta)g}{1+\delta}. \quad \therefore v^2 = 2fs. \quad \text{Also } h+d : h+d-s = x^3 : r^3.$$

$$\therefore s = \frac{(x^3 - r^3)(h+d)}{x^3}. \quad \therefore v^2 = \frac{2f(x^3 - r^3)(h+d)}{x^3}.$$

$$\therefore \frac{v^2 x^3}{x^3 - r^3} = 2f(h+d) = \frac{2(1-\delta)(h+d)g}{1+\delta}$$

d can be found by either method in Vol. I, page 134.

202. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

Three equal, uniform, similar rods AB , BC , CD , freely jointed at B and C , are hung from a point by two equal strings attached at A and D . Find the position of equilibrium.

Solution by G. W. GREENWOOD, M. A., Dunbar, Pa.

By symmetry, the strings, of length l , say, make equal angles with the vertical, as do also the rods AB and DC ; denote these angles by θ and ϕ , respectively. The rod BC is horizontal. Denote the length of each rod by a , the weight by w , and the depth of the center of gravity of the system below the point of support by z , the strings being regarded as weightless.

$$\begin{aligned} z &= [w(l \cos \theta + \tfrac{1}{2}a \cos \phi) + w(l \cos \theta + a \cos \phi) + w(l \cos \theta + \tfrac{1}{2}a \cos \phi)] / 3w \\ &= \tfrac{1}{3}[3l \cos \theta + 2a \cos \phi]. \end{aligned}$$

For equilibrium, the value of z must be a maximum.

$$\therefore 0 = 3l \sin \theta d\theta + 2a \sin \phi d\phi \dots (1).$$

Also, by horizontal projection,

$$a = 2l \sin \theta + 2a \sin \phi \dots (2).$$

$$\therefore 0 = l \cos \theta d\theta + a \cos \phi d\phi \dots (3).$$

$\therefore 3 \tan \theta = 2 \tan \phi$ (by eliminating $d\theta$ and $d\phi$ from (1) and (2)). This equation, with equation (3), gives the position of equilibrium.

Also solved by G. B. M. Zerr and J. Scheffer.

AVERAGE AND PROBABILITY.

187. Proposed by HENRY HEATON, Belfield, N. D.

Through every point of a given square straight lines are drawn in every possible direction, terminating in the sides of the square. What is the average length of such lines?

II. Solution by G. B. M. ZERR, A. M., Ph. D., 4243 Girard Avenue, Philadelphia, Pa.

Let $ABCD$ be the given square, side a . P the random point coordinates (u, v) . On account of the symmetry of the square we will confine P to the triangle ADC . Let EQ be the random line through P , $m = \tan \theta = \tan QED$. For the area AOD , E must fall on HF to intersect opposite sides and on AH to intersect adjacent sides. For the area COD , E must fall on